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ABSTRACT

In this replication of the 1972 and 1974 studies of reading and mathematics achievement in North York, Ontario, approximately 20 percent of the students at each of the proposed grade levels were included in the sampling. Again, the Metropolitan Achievement Test, the Sequential Tests of Educational Progress, and the School and College Ability Test were used. The 1975 results supported the 1974 findings that North York achievement in both reading and mathematics compared favorably with the American norms in all the grades tested. They also indicated that the average growth of the schools sampled was wider in both reading and mathematics than in previous years. (Author/BW)

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NORTH YORK BOARD OF EDUCATION

# RESEARCH REPORT

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## 1975 REPLICATION OF:

## A SURVEY OF MATHEMATICS AND READING SKILLS

A.E. Virgin

M. Rowan

June, 1975

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TM005 659

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## INTRODUCTION AND PROCEDURE

### Background

In September 1974, the Assistant Director of Education requested that a survey of some Reading and Mathematics Skills be conducted across the borough. Subsequently, a proposal was developed by a committee whose members are:

N.O. Brodie, Assistant Superintendent of Schools.
Mrs. R. Charlesworth, Co-ordinator of English.
W.M. Day, Co-ordinator of English (Acting).
J.J. Del Grande, Co-ordinator of Mathematics.
E.C. Porter, Assistant Superintendent of Schools.
A.E. Virgin, Co-ordinator, Educational Research Services.

The proposal was endorsed by Academic Council on February 13th.

### Sample

Each Area had proportional representation in terms of the student population. Approximately 20% of the students at each of the proposed grade levels were included in the sampling. The secondary schools were chosen randomly from within each Area. Elementary and junior-high schools were selected from within each of the Families determined by the representative secondary schools, on the basis of a stratified random-sampling. Selected students from grades 6, 9 and 12 were required to participate in the survey. "As-is" classes were used at all levels, provided the students were not streamed.

In order to obtain a 20% sample of students at each grade level that would reflect the pupil population of each area in the borough, the following selection procedure was used. Eleven secondary schools were chosen on a random basis but such that three secondary schools would be chosen in each of the Western, Northeastern and Southeastern Areas and two secondary schools in the Central Area. Four classes at the grade 12 level were involved in each school. Fifteen junior high schools were chosen from within the Families of the selected schools such that six schools and three grade nine classes per school were chosen in the Western Area. Two schools and four grade nine classes per school in the Central Area; four schools and four grade nine classes per school in the Northeastern Area; three schools and five classes per school in the Southeastern Area. Twenty-six elementary schools were chosen from the selected Families such that eight schools and two grade six classes per school were chosen in each of the Western and Northeastern Areas; six schools and two grade six classes per school in the Southeastern Area; four schools and two grade six classes per school in the Central Area.

The table below summarizes the number of schools and corresponding number of students from whom test data were gathered at each level.

TABLE 1

| Grade Level | Number Of Schools | Number Of Students |
|---|---|---|
| 6 | 28 | 1442 |
| 9 | 15 | 1282 |
| 12 | 11 | 959 |

Selection of Tests

Metropolitan Achievement Test (MAT)

In an earlier study, where the Metropolitan Achievement Test was used, two sub-tests measuring aspects of reading, and three subtests measuring mathematics, were administered. The results of that study indicated that there were high correlations (ranging from .7 - .9) between the subject related subtests, and therefore it was deemed unnecessary to give all five subtests.

The Reading Comprehension subtest was administered to Grades 3, 6 and 9. This consists of 45 items designed to measure pupils' ability to comprehend written material. Items cover comprehending literal meaning of passages, drawing inferences, identifying main ideas and determining word meanings from context.

The Mathematics Computation subtest was administered to Grades 3, 6 and 9. This subtest contains 40 items covering basic arithmetic skills including decimals and fractions. The number of items used in each subtest is the same, with the difficulty of the items appropriate to the grade level for which it is intended.

Sequential Tests of Educational Progress (STEP)

The reading test administered to Grade 12 is the Sequential Tests of Educational Progress (STEP). This test is designed to assess five major reading-for-comprehension skills, i.e. the abilities to reproduce ideas, to translate ideas and make inferences, to analyze motivation, to analyze presentation, and to criticize.

The items require identification of details, analysis, interpretation and criticism of passages such as newspaper and magazine articles, letters, stories, poetry, plays, essays, etc.

The test is divided into two parts, Vocabulary and Reading Comprehension: the number of correct responses determines the total reading score. To permit statistical comparisons this is changed to a "converted score". Converted scores can be easily translated into nationally normed (U.S.) percentile rankings.

School and College Ability Test (SCAT)

The SCAT is a series of aptitude tests designed to evaluate a student's capacity to perform verbal and mathematical skills. The quantitative portion of form 2A recommended for Grades 10 - 12 was administered to the Grade 12's. This portion of the test consists of 50 items involving various levels of computation and arithmetic reasoning. Each item involves the student in a multiple choice selection of the preferred answer to a mathematics question including geometry, simple algebra, graphs, number systems, etc.

The conversion of a student's raw score to a converted score and then to a percentile rank is similar to the method used in the STEP series.

Administration

As a preliminary to the testing, an organizational session was held to orient the participating school principals and teachers. Test materials and instruction sheets were distributed and administrative procedures discussed. The tests were administered by the teachers.

The tests were administered at each grade level according to the following schedule:

TABLE 2

| Grade | Number Of Sittings | Number Of Days | Total Writing Time |
|---|---|---|---|
| 6 | 2 | 2 | 60 minutes |
| 9 | 2 | 1 or 2 | 80 minutes |
| 12 | 1 | 1 | 65 minutes |

At each grade, student responses were recorded on computer sheets and subsequently scored and analyzed.

## RESULTS

The results of the data analyses are discussed in two sections, Reading Skills and Mathematics Skills respectively. In each section, the results are presented separately for each of the three grade levels. At each grade level, the following information is reported.

1. The number of pupils across the Borough for whom that test data were gathered.

2. The mean 1975 score for North York.

3. The expected mean score.

4. Comparisons of the performance - levels of North York students in 1972 and 1974.

5. The range of mean scores from the participating schools.

6. The standard deviation of raw scores which indicates the range of approximately 68% of the scores for each school.

7. The total range of scores for each school.

## Section One: Reading Skills

### Grade 6

The following table presents Borough mean raw score and corresponding grade equivalent scores for the Reading subtest of the Metropolitan Achievement test (MAT), administered to Grade 6 pupils.

TABLE 3

DESCRIPTIVE STATISTICS FOR THE READING COMPREHENSION SUBTEST OF THE M.A.T. GRADE 6 LEVEL

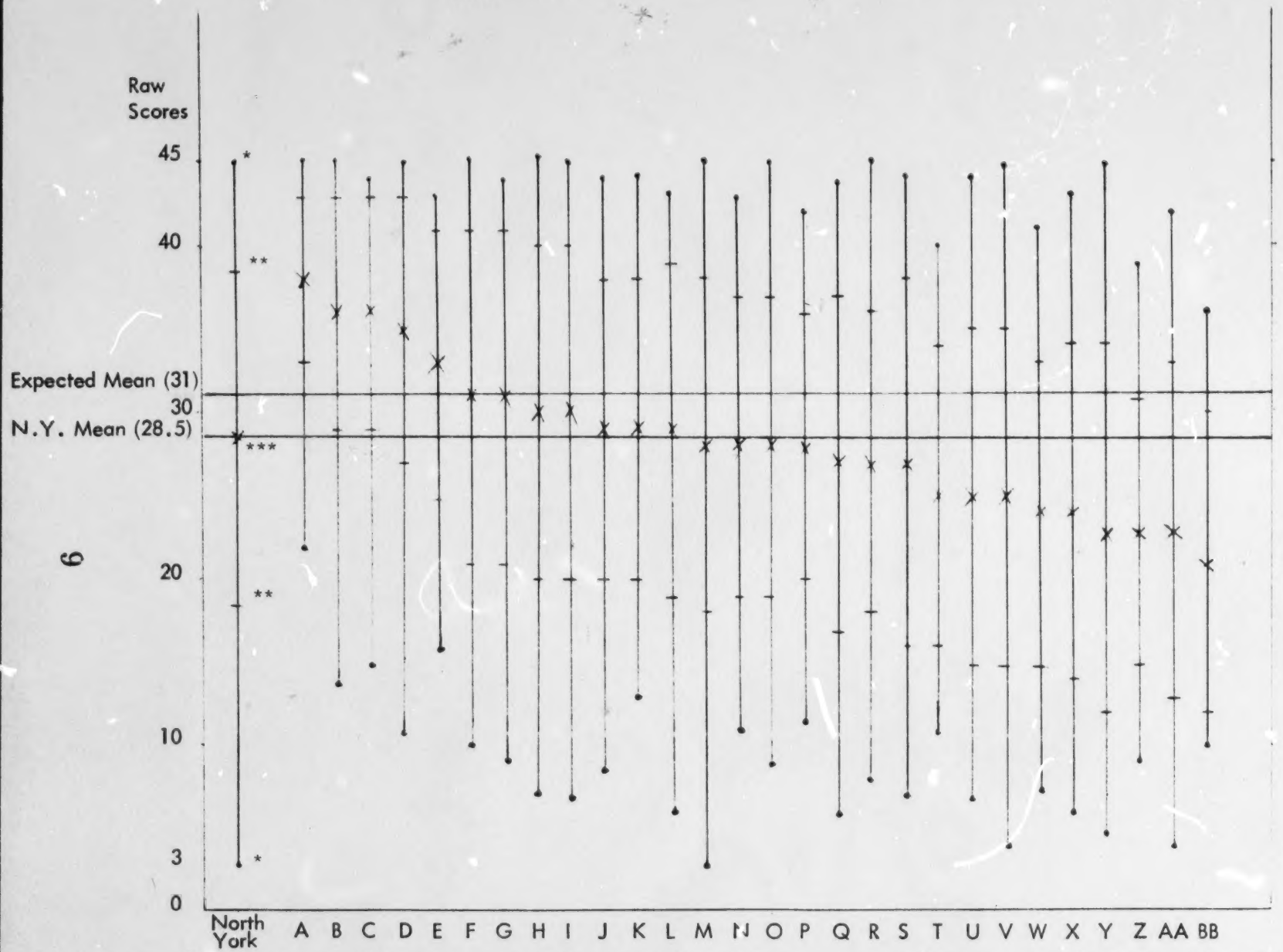
| | North York Mean | | Expected Mean | | Number Of Students | Range Of School Means(G.E.) |
|---|---|---|---|---|---|---|
| | Raw Score | Grade Equivalent | Raw Score | Grade Equivalent | | |
| 1975 | 28.5 | 6.4 | 31.0 | 6.7 | 1443 | 5.1 - 8.7 |
| 1974 | 29.5 | 6.5 | 29.5 | 6.5 | 1532 | 5.7 - 7.9 |
| 1972 | 30.5 | 6.6 | 29.5 | 6.5 | 1574 | 5.7 - 7.9 |

It should be noted that while the actual 1975 mean is 0.1 grade equivalents lower than last year, testing occurred two months later. Thus, there is a difference of three months, corresponding to a decrease of 2.5 in the number of correct items out of 45 in the reading sub test. Note that the range of school means has increased. Thus, two observations can be explained in part by the fact that a stratified random sample was drawn, while in previous years each area was equally represented.

The differences among individual schools in North York are illustrated in Graph 1. Based on the rank order of means for Grade 6 Reading Comprehension subtest, the 28 elementary schools were given a code letter from A through Z and BB.

In this graph there is a relatively gradual decrease in the mean scores with the maximum difference between the highest and lowest mean being 17 test items (3.6 grade equivalent

GRAPH 1: DISTRIBUTION OF SCORES ON M.A.T. READING COMPREHENSION SUBTEST - GRADE 6 .




* Total Range of Scores ** One Standard Deviation *** Mean **** Based on U.S. Published Norms, 1971

ELEMENTARY SCHOOLS

years). This difference indicates an increase in variation of school means at the Grade 6 level, compared to the other two test years (12 test items, 2.2 grade equivalent years). As already stated, part of this increased variation compared to the other test years, is a result of the stratified random sampling employed in 1975.

The wide range within each school illustrated this year, depicts the challenge faced by teachers to individualize their teaching techniques.

Grade 9

The following table presents Borough mean raw scores and corresponding grade equivalents for the Reading subtest of the Metropolitan Achievement Test, Advanced Level, administered to Grade 9 students in 1975.

TABLE 4

DESCRIPTIVE STATISTICS FOR THE READING SUBTEST
OF THE MAT GRADE 9 LEVEL

| | North York Mean | | Expected Mean | | Number Of Students | Range of School Means (G.E.) |
|---|---|---|---|---|---|---|
| | Raw Score | Grade Equivalent | Raw Score | Grade Equivalent | | |
| 1975* | 32.0 | 9.5 | 40 | 9.7 | 1288 | 7.8 - 9.6 |

* In previous years a different test was used. The resulting standard scores and norms are very different from those used for the M.A.T. and therefore we cannot compare results.

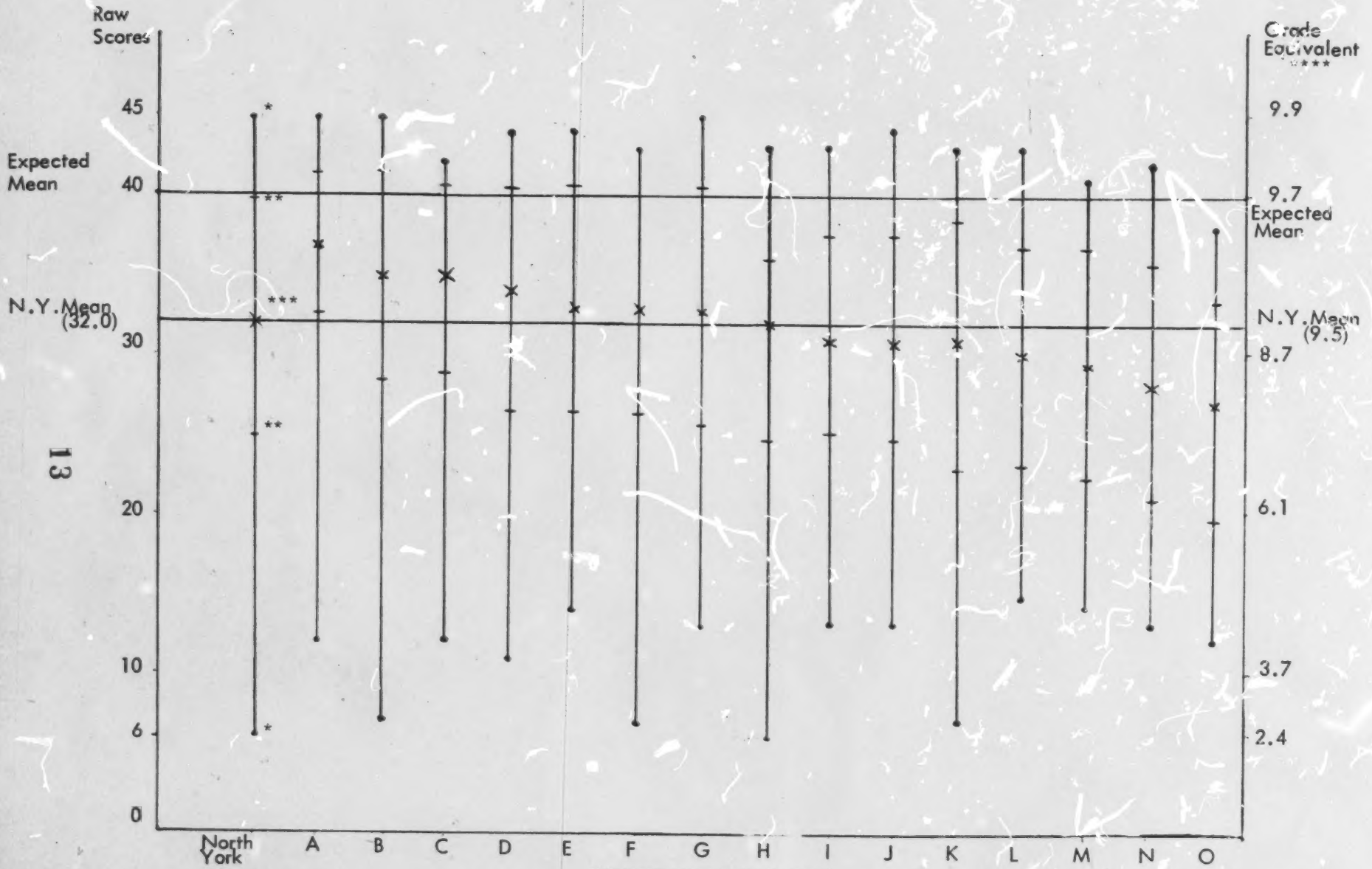
The test selected, the M.A.T. Advanced, is intended for students from the beginning of Grade 7 to March of the Grade 9 year. As the test was administered in April of the Grade 9 year, a topping effect was expected and indeed occurred. This can be seen by noting that the borough mean grade equivalent of 9.5, corresponds to a raw score of 32 out of 45, while 9.7 G.E. is equivalent to 40. Thus, an increase of 8 raw score points only increases the grade equivalent by 0.2 at this top level, whereas at the Grade 8 level a raw score change of 1 is equal to a grade equivalent change of 0.2

In Graph 2 the schools have been assigned a letter code, according to the numerical order of the schools' raw score means from high to low.

Although the test was administered to Grade 9 students in their seventh month, the graph shows that in only 3 of the 15 junior high schools sampled, were there students that obtained a perfect score of 45. In all 3 cases, the school mean was above the average mean for the Borough.

The range of school means indicates that the average student score for the different schools varies by 10 test items on the 45 item test.

GRAPH 2 : DISTRIBUTION OF SCORES ON M.A.T. READING COMPREHENSION SUBTEST - GRADE 9



Grade 12

The following table presents Borough mean raw scores and standard scores for the Reading subtest of the Sequential Tests of Educational Progress (STEP) administered to Grade 12 students in 1975.

TABLE 5

DESCRIPTIVE STATISTICS FOR THE READING SUBTEST OF THE STEP GRADE 12 LEVEL

| | North York Mean | | Expected Mean* | | Number Of Students | Range of School Raw School Means |
|---|---|---|---|---|---|---|
| | Raw Score | Standard Score | Raw Score | Standard Score | | |
| 1975 | 42 | 470 | 40 | 467 | 959 | 3[illegible] - 45 |
| 1974 | 42 | 470 | 38 | 464 | 531 | 40 - 45 |
| 1972 | 44 | 473 | 39 | 465 | 465 | 40 - 47 |

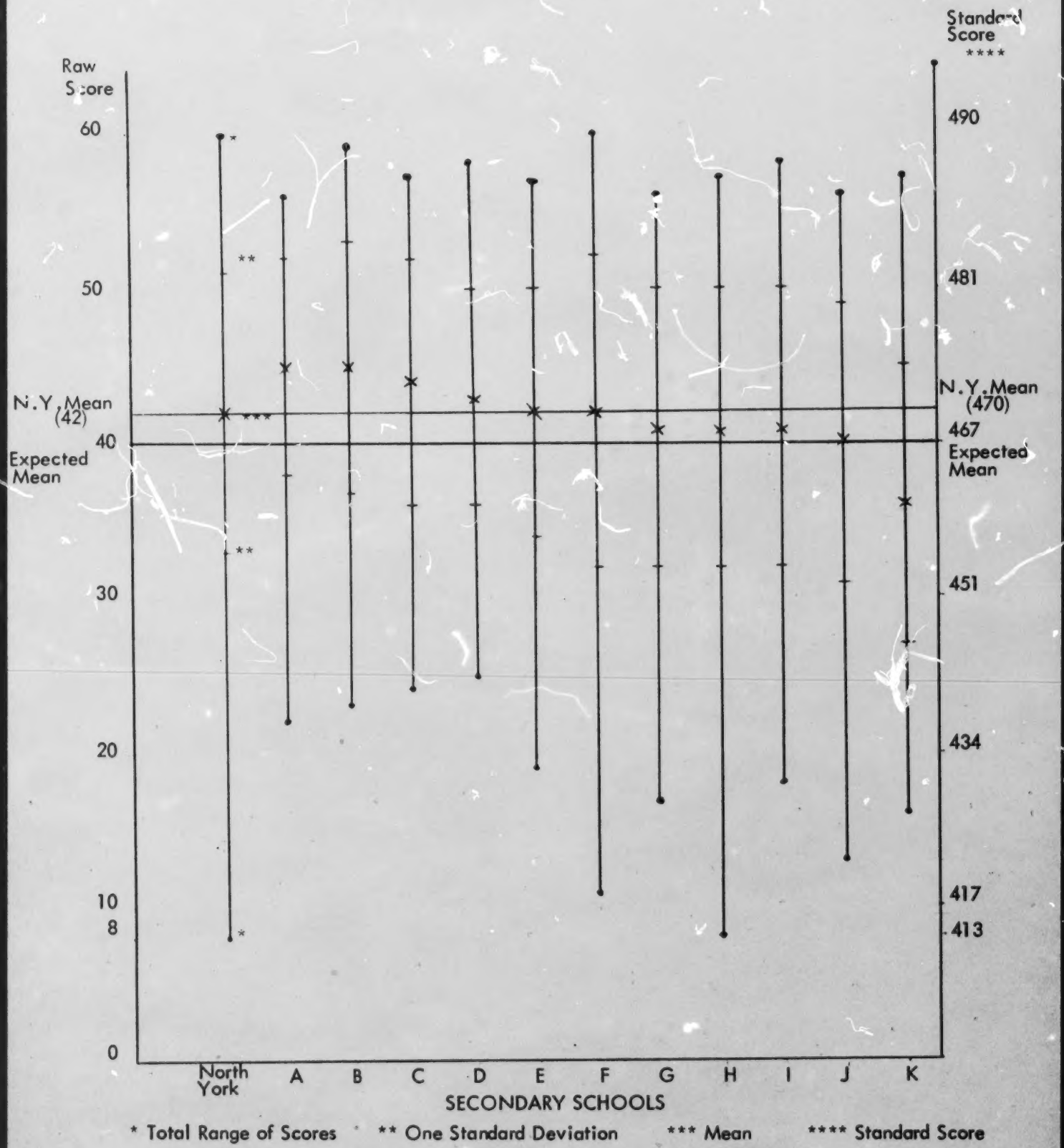
* 1972 and 1974 expected means are based on the fall norms of U.S. Grade 12 students while the 1975 expected means are based on U.S. spring norms.

The North York raw score mean indicates that students are still performing somewhat above the level expected of typical American students in the spring. The results also indicate that the average students are achieving the same level, but two months later in the school year.

The range of school means obtained in April 1975 also illustrates a wider range of achievement compared to the results obtained in February, 1974. The range indicates an increased variation of school means from 15 test items (1974) to 19 test items.

In Graph 3 ten of the eleven school means are equal to or higher than the U.S. expected mean. It should be noted that the wide range of scores for each school represents a relatively proportionate sample of both advanced and general level Grade 12 student populations for each school.

GRAPH 3: DISTRIBUTION OF SCORES ON STEP SERIES II
FORM 2A READING GRADE 12



## Section Two: Mathematics Skills

### Grade 6

The following table presents Borough mean grade equivalent scores for the Mathematics Computation Subtest of the Metropolitan Achievement Test (MAT), administered to Grade 6 pupils in 1972 and 1974.

TABLE 6

DESCRIPTIVE STATISTICS FOR THE MATHEMATICS COMPUTATIONS SUBTEST OF THE M.A.T. GRADE 6 LEVEL

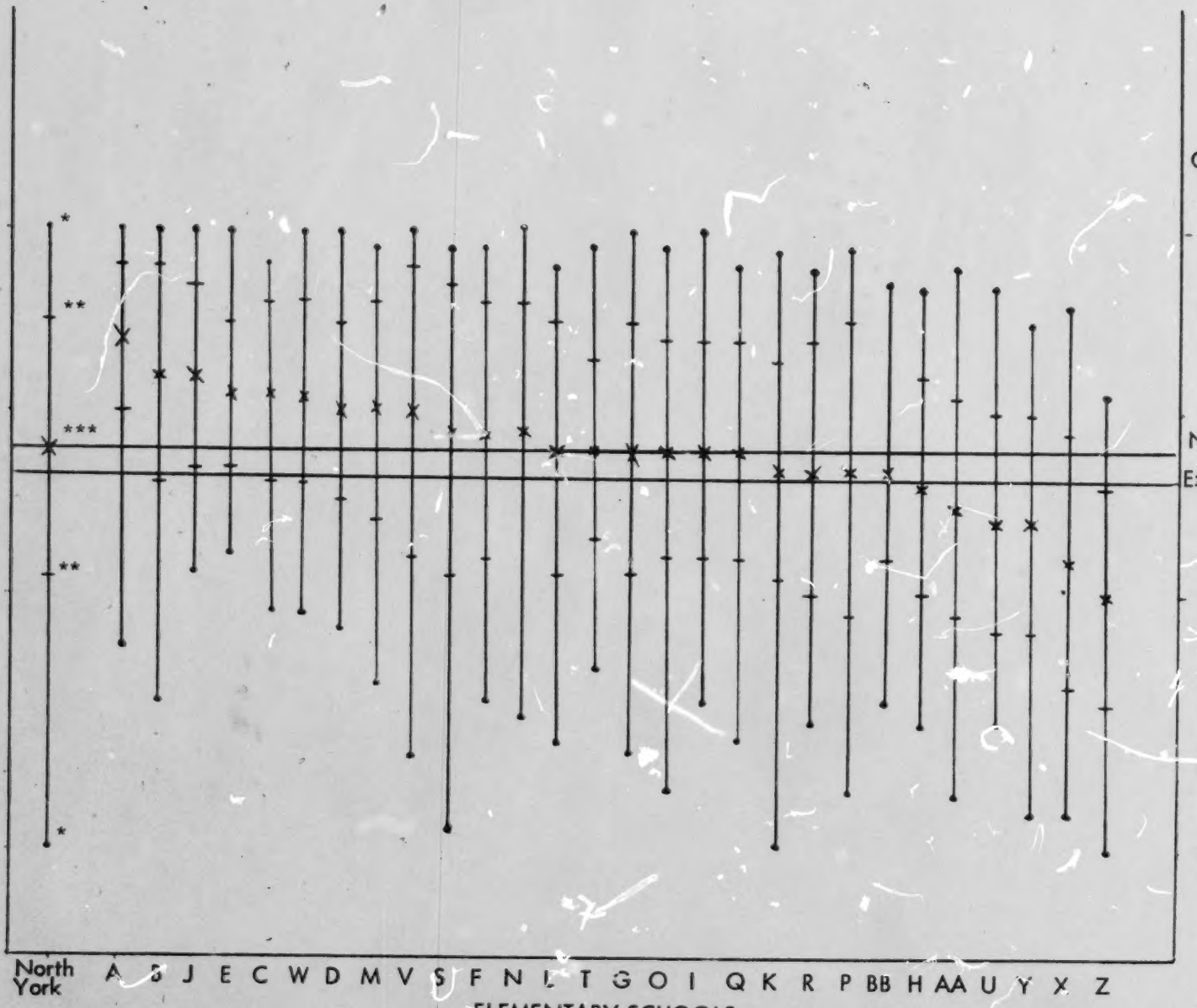
| | North York Mean | | Expected Mean | | Number Of Students | Range Of School Mean (G.E.) |
|---|---|---|---|---|---|---|
| | Raw Score | Grade Equivalent | Raw Score | Grade Equivalent | | |
| 1975 | 28.0 | 7.1 | 26.5 | 6.7 | 1441 | 5.6 - 8.8 |
| 1974 | 29.5 | 7.4 | 25.5 | 6.5 | 1545 | 6.4 - 8.5 |
| 1972 | 28.5 | 7.2 | 25.5 | 6.5 | 1602 | 6.3 - 8.3 |

The 1975 grade equivalent mean indicates that the North York students are still achieving above the expected mean of the test. This indicates that North York students average 1.5 items above the expected out of 40 in the mathematics computation subtest. In comparison to previous years, the students average 1.5 (1974) and 0.5 (1972) lower. This decline can be explained in part by the more representative sample used this year as explained in the previous reading results on page 5.

The differences among individual school means in North York are illustrated in Graph 4 . Schools have been assigned the same letter code used with the results for Grade 6 Reading.

In Graph 4 there is a relatively gradual decrease in the mean scores, with a maximum difference between the highest and lowest mean being 14 test items (3.2 grade equivalent years). This difference indicates a widening variation of school means at the Grade 6 level of mathematic computation compared to the other two test years (7.5 test items, 2.0 - 2.1 grade equivalent years). It should be noted here again that this increased variation incorporates the change from an equal sampling technique in previous years to a stratified technique employed this year.

GRAPH 4 : DISTRIBUTION OF SCORES ON M.A.T. MATHEMATICS COMPUTATION SUBTEST - GRADE 6




* Total Range of Scores  ** One Standard Deviation  *** Mean  **** Based on U.S. Published Norm, 1971

Grade 9

The following table presents descriptive statistics for the Mathematics Computation subtest of the Advanced Level of the Metropolitan Achievement Tests (M.A.T.), administered to Grade 9 students in 1975, 1974 and 1972.

TABLE 7

DESCRIPTIVE STATISTICS FOR THE MATHEMATICS COMPUTATION SUBTEST OF THE M.A.T. GRADE 9 LEVEL

| | North York Mean | | Expected Mean | | Number of Students | Range of School Means (G.E.) |
|---|---|---|---|---|---|---|
| | Raw Score | Grade Equivalent | Raw Score | Grade Equivalent | | |
| 1975 | 32.3 | 9.6 | 36 | 9.7 | 1275 | 8.5 - 9.7 |
| 1974 | 31 | 9.6 | 29 | 9.5 | 576 | 8.8 - 9.6 |
| 1972 | 31 | 9.6 | 29 | 9.5 | 580 | 8.8 - 9.6 |

The scoring and analysis again this year was in terms of raw scores similar to the procedures used in 1974. The borough and school grade equivalents were obtained by conversion of the mean raw scores which provide only an approximation of the mean of the individual grade equivalent scores.

As the test was administered in April of the Grade 9 year (at 9.7 G.E. level, a topping effect was expected since the maximum grade equivalent for the test is 9.9. Basing the analysis on a raw score comparison serves to accommodate the potential "topping" or "ceiling effect" on the scores of the many above-average students in the sampling.

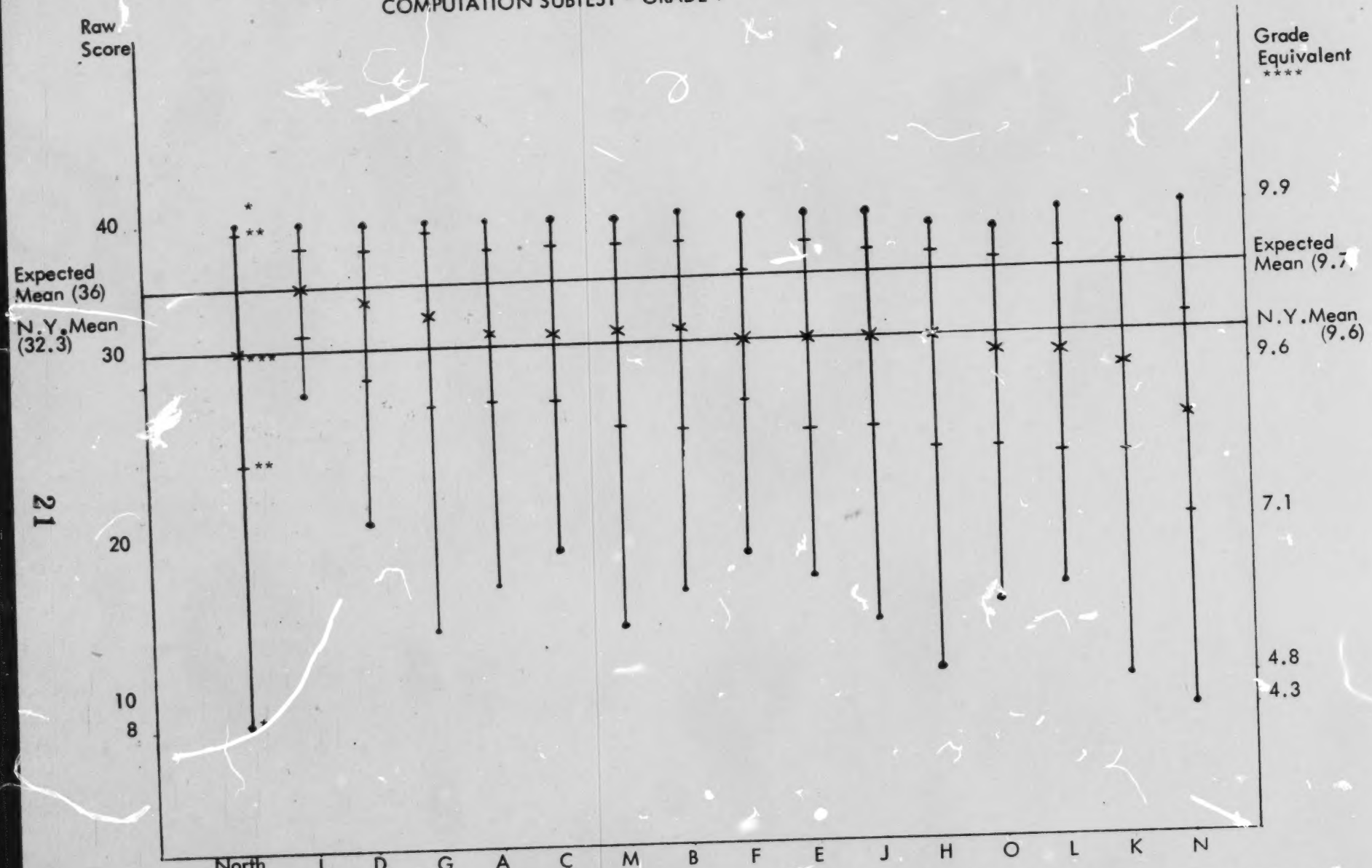
In terms of their raw score performance on the mathematics computation subtest, North York students are achieving at a level comparable to the classes of '72 and '74.

In Graph 5 the Junior High schools have been assigned the same letter code previously used for the coding of the Grade 9 reading.

Twelve of the fifteen schools sampled contained students who obtained perfect scores of 40. Also, the upper limit of the standard deviation is between 36 and 40 for most schools. This suggests that the "topping effect" of the mathematics computation subtest may have caused a depression of the overall Borough raw score mean.

The range of school means indicates that the average student raw scores for the different schools varied by 9 test items.

GRAPH 5 : DISTRIBUTION OF SCORES ON MAT MATHEMATICS COMPUTATION SUBTEST - GRADE 9



Grade 12

The following table presents descriptive statistics for the mathematics subtest (i.e. Part II) of the School and College Ability Tests (SCAT) administered to Grade 12 students in 1975.

TABLE 8

DESCRIPTIVE STATISTICS FOR SCAT 2A, PART TWO
GRADE 12 LEVEL

| | North York Mean | | Expected Mean* | | Number Of Students | Range of School Raw School Means |
|---|---|---|---|---|---|---|
| | Raw Score | Standard Score | Raw Score | Standard Score | | |
| 1975 | 36 | 305 | 32 | 297 | 959 | 32 - 40 |
| 1974 | 36 | 305 | 32 | 297 | 530 | 33 - 37 |
| 1972 | 37 | 307 | 32 | 297 | 467 | 34 - 38 |

* The expected means are based on fall norms of U.S. students in Grade 12

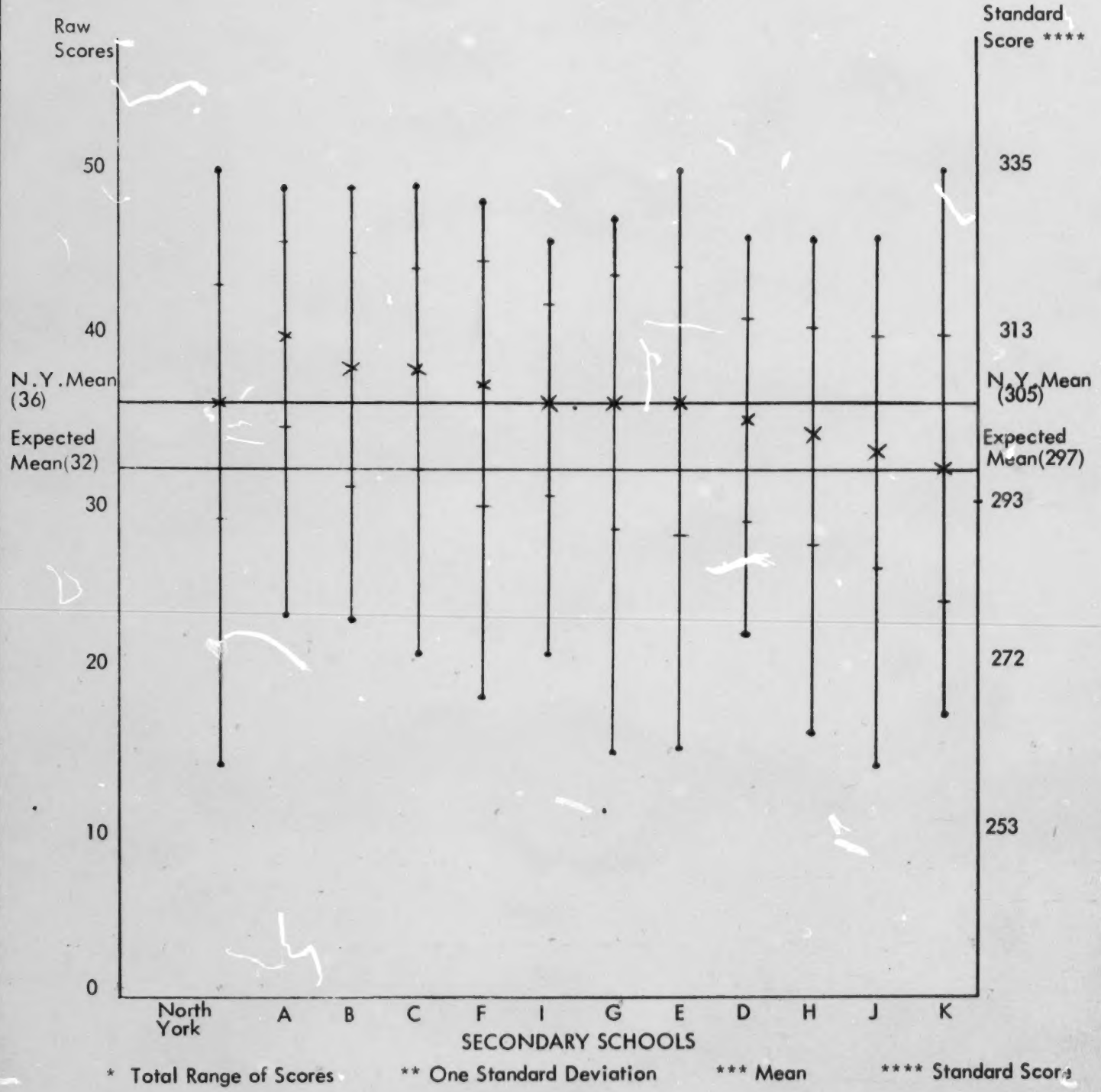
The North York raw score mean indicates that students are still achieving somewhat above the level expected of typical American students in the fall, of the Grade 12 year, based on the test of fundamental numbers operation. The 1975 data indicates that the students are achieving at the same level as in February, 1974.

The later date of testing (April) is indicated by the range of school means. In 1974 the maximum school means for schools tested in February was 37, in comparison, a maximum of 40 was obtained by a school tested in April of 1975. At the same time, the lower range of school means indicates a lower average achievement level in one school, compared to last year.

In graph 6 all North York schools sampled averaged equal to or higher than the expected mean for the test. The reader is again reminded that as testing in North York was completed during April, six months after the norm group, North York students are therefore at some advantage when compared with the U.S. sample.

It should also be noted that the wide range of student scores and school means represents a relatively proportionate sample of advanced and general level students from eleven different high schools in the Borough.

GRAPH 6: DISTRIBUTION OF SCORES ON SCAT SERIES II
FORM 2A MATHEMATICS GRADE 12.




* Total Range of Scores ** One Standard Deviation *** Mean **** Standard Score

## SUMMARY

The preceding results may be summarized as follows:

(A) In General

1. North York achievement in both reading and mathematics compares favourably with the American norms in all grades tested.

2. The average growth of the schools sampled is wider in both reading and mathematics than in previous years

(B) In Reading

1. Grade 6's, 1975 results indicate a continuing drop of the raw score mean.

2. Grade 9's, 1975 results are very close to the expected results for the test.

3. Grade 12's, 1975 results are similar to 1974, but were obtained two months later in the school year.

(C) In Mathematics

1. Grade 6's, 1975 results although higher than the average expected for the test, are lower than the average North York raw scores obtained from sampling in 1972 and 1974.

2. Grade 9's, 1975 results show that students are achieving at a higher level (32.3 test items correct) indicative of the later time of testing, yet comparatively they are achieving at the same level as in previous years.

3. Grade 12's, 1975 results indicate that students are achieving at the same level as in 1974 but two months later.

These results are also presented in summary form in the following table.

TABLE 9

SUMMARY OF NORTH YORK RESULTS

| Grade | | READING | | | MATHEMATICS | | |
|---|---|---|---|---|---|---|---|
| | | "A" Mean Raw Score | "B" Mean 'Standard Score | "C" Expectation Corresponding to "B" | "D" Mean Raw Score | "E" Mean 'Standard Score | "F" Expectation Corresponding to "E" |
| 6 | 1975 | 28.5* | 6.4 g.e | 6.7 g.e. | 28.0*** | 7.1 g.e. | 6.7 g.e. |
| | 1974 | 29.5* | 6.5 g.e. | 6.5 g.e. | 29.5*** | 7.4 g.e. | 6.5 g.e. |
| | 1972 | 30.5* | 6.6 g.e. | 6.5 g.e. | 28.5*** | 7.2 g.e. | 6.5 g.e. |
| 9 | 1975 | 32.0* | 9.5 g.e. | 9.7 g.e. | 32.3*** | 9.6 g.e. | 9.7 g.e. |
| | 1974 | 37.0** | 450 | 450 (fall) | 31.0*** | 9.6 g.e. | 9.5 g.e. |
| | 1972 | 41.0** | 456 | 450 (fall) | 31.0*** | 9.6 g.e. | 9.5 g.e. |
| 12 | 1975 | 42** | 470 | 467 (spring) | 36**** | 305 | 297 (fall) |
| | 1974 | 42** | 470 | 464 (fall) | 36**** | 305 | 297 |
| | 1972 | 44** | 473 | 465 (fall) | 37**** | 307 | 297 |

*on 45-item subtest (M.A.T.)
**on 60-item subtest (S.T.E.P.)
***on 40-item subtest (M.A.T.)
****on 50-item subtest (S.C.A.T.)

1) 1975 results are based on a proportional random sampling whereas the 1972 and 1974 results are based on equal sampling of the whole Borough.

2) The 1975, grade 9 reading results were obtained using the M.A.T. subtest whereas the 1972 and 1974 results were obtained using the S.T.E.P. test which yielded different types of numerical data.